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# CONVENTIONAL BRÄCKE SITE PREPARATION AS EFFECTIVE AS MOUNDING

by
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**CATEGORY:** Silviculture
**KEY WORDS:** mounding, microsite, Bräcke scarification, patch shoulder, site preparation, jack pine, black spruce, boreal Ontario, plantation establishment

## INTRODUCTION

Successful establishment of forest tree plantations is seldom possible without site preparation of some kind. The Bräcke scarifier is one site preparation tool that has been extensively employed in boreal Ontario for many years. It creates uniformly spaced patches, each of which provides a choice of two distinct microsites, the bottom or the shoulder of the patch. Although planting on either of these microsites has produced many successful plantations, mounding has been advocated as having the potential to further improve results. The suggested benefits of mounding include increased soil temperature, improved drainage and reduced competition from minor vegetation.

To evaluate the utility of mounding site preparation for establishing jack pine (*Pinus banksiana* Lamb.) and black spruce (*Picea mariana* [Mill.] B.S.P.) in boreal Ontario, a study sponsored by the Ontario Ministry of Natural Resources (OMNR) was begun in 1979. The study compared the 5-year performance of seedlings planted without site preparation, after Bräcke scarification only, and after simulated Bräcke mounding.

The study was conducted in collaboration with the Great Lakes Forestry Centre of the Canadian Forestry Service (now Forestry Canada, Ontario Region), with partial funding by the Canada–Ontario Forest Management Subsidiary Agreement. The senior author designed and supervised the study and analyzed the results; fieldwork was conducted by KBM Forestry Consultants Inc. of Thunder Bay, Ontario. A complete report on all aspects of this study is presented by Sutton (1991); only the major findings are reported in this note.

## APPROACH

In 1980, 1981 and 1982, bareroot 2+0 jack pine and $1^1/_2$+$1^1/_2$ black spruce were planted in the spring in replicated plots at 11 locations ("sites") from Ignace to Cochrane (Fig. 1). On jack pine sites, soil textures were primarily medium sand, but covered a range from silt loams to gravelly sandy loams and medium sands. Soil textures on black spruce sites ranged from clays through silt loams to sands over loamy sands. The selected sites are considered representative of those on which jack pine and black spruce are typically planted in boreal Ontario.

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*Figure 1. Map of Ontario, showing the locations of the planting sites.*

In each case, site preparation was carried out during the year before planting to provide five kinds of plantable microsite (Fig. 2).

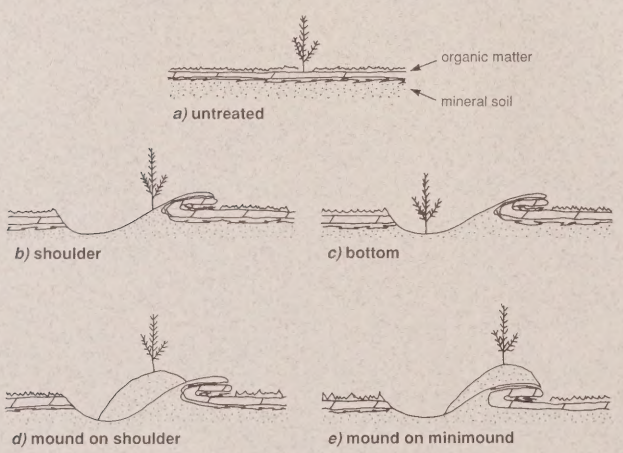


*Figure 2. Diagram of the five plantable microsites:*

- *a) untreated (i.e., no site preparation);*
- *b) shoulder of the Bräcke patch;*
- *c) bottom of the Bräcke patch;*
- *d) 20-L mound of mineral soil heaped on the shoulder of the Bräcke patch;*
- *e) 20-L mound of mineral soil heaped on the divot of primarily organic matter scuffed out during creation of the associated Bräcke patch.*

Treatment to create microsites "b" through "e" involved the use of a Bräcke scarifier; the 20-L mounds in microsites "d" and "e" were added manually to simulate the site preparation effected by a Bräcke mounder.

On each site, four 30-tree plots (replicates) per microsite were planted by means of the "operational slit" method. Immediately after planting, all trees were measured for total height and ground-level stem diameter. Five trees per plot were sacrificed 30 days after planting to determine root growth (Sutton 1987). The survival and growth of the remaining trees were assessed at the end of the first, second, third and fifth years.

The data were examined primarily to allow a comparison of the effect of mounding site preparation with that of conventional Bräcke scarification. Sutton (1991) provides results for all parameters examined; this note deals only with survival and height growth at the end of the fifth year after outplanting. However, because the growth of an outplant is influenced by initial tree size (i.e., larger trees produce greater growth than smaller trees), height growth comparisons are limited here to relative growth rates (RGRs). This calculation takes initial size into account, thereby permitting valid comparisons of rates (instead of quantities) of growth.

Before examining the results, the reader should remember that individual lots of planting stock (even from the same Site Region and nursery) can vary considerably, both morphologically and physiologically. Unfortunately, this means that a given site preparation treatment might not influence the performance of all batches of planting stock in the same way or to the same degree. In a study such as this, further complications are caused by differences in sites and soils, and by the interaction of these factors with variability in weather patterns from year to year. To determine the extent to which some of the foregoing factors might affect seedling performance, the seed lots were identified and the planting stock was characterized in terms of initial height and stem diameter. These measurements were supplemented by determinations of root growth capacity (RGC) and by test plantings in the nursery. The detailed results of these supplemental studies are described elsewhere (Sutton 1984, 1991). In summary: all lots of planting stock showed excellent viability, and there was little correlation between performance and initial stock size, between stock size and RGC, and between RGC and field performance. This is encouraging in that it strengthens the main conclusions that can be drawn from this study.

## RESULTS

Table 1 contains the average fifth-year survival rates, by year of planting and microsite, for jack pine and black spruce. As all plantings showed a broadly similar response to treatment, a breakdown showing survival by individual sites is omitted for the sake of brevity.

Table 1. Average fifth-year survival rates (%) of jack pine and black spruce outplantings, by year of planting and by microsite.

| | Survival (%) on microsite[a] | | | | | |
|---|---|---|---|---|---|---|
| Year of planting | a | b | c | d | e | a-e |
| Jack pine | | | | | | |
| 1980 | 88 | 94 | 92 | 96 | 94 | 92.8 |
| 1981 | 85 | 93 | 92 | 87 | 67 | 84.8 |
| 1982 | 83 | 94 | 89 | 98 | 98 | 92.4 |
| Mean | 85 | 94 | 91 | 95 | 88 | 90.6 |
| Black spruce | | | | | | |
| 1980 | 88 | 86 | 69 | 90 | 84 | 83.7 |
| 1981 | 91 | 94 | 72 | 97 | 83 | 87.4 |
| 1982 | 89 | 95 | 92 | 98 | 97 | 94.2 |
| Mean | 89 | 91 | 78 | 95 | 89 | 88.8 |

[a] Microsites are shown in Fig. 2.

Survival, averaged over all plantings, was high for both species on all microsites and the differences among microsites were generally small. For both species, the highest overall survival occurred on microsites "b" and "d" (Fig. 2). Thus, on the basis of survival, mounding was not superior to conventional Bräcke scarification with planting on the shoulder.

Table 2 contains the average fifth-year RGR (height) values. For both species, overall average RGRs were highest on microsite "b". The most critical observation is that RGRs (height) of trees planted on mounds (microsites "d" and "e") averaged less than those of trees planted on the shoulder of conventional Bräcke patches (microsite "b"). Thus, as with survival, height growth was not benefited by mounding in comparison with conventional Bräcke scarification followed by planting on the shoulders of the patches.

Table 2. Average fifth-year RGR(height) of jack pine and black spruce outplantings, by year of planting and microsite.

| | RGR (height) on microsite[a] | | | | | |
|---|---|---|---|---|---|---|
| Year of planting | a | b | c | d | e | a-e |
| Jack pine | | | | | | |
| 1980 | 0.44 | 0.56 | 0.44 | 0.45 | 0.45 | 0.468 |
| 1981 | 0.41 | 0.41 | 0.38 | 0.38 | 0.40 | 0.396 |
| 1982 | 0.37 | 0.40 | 0.39 | 0.39 | 0.40 | 0.390 |
| Mean | 0.407 | 0.457 | 0.403 | 0.407 | 0.417 | 0.418 |
| Black spruce | | | | | | |
| 1980 | 0.25 | 0.25 | 0.21 | 0.26 | 0.24 | 0.242 |
| 1981 | 0.22 | 0.23 | 0.20 | 0.22 | 0.22 | 0.218 |
| 1982 | 0.27 | 0.29 | 0.28 | 0.26 | 0.26 | 0.272 |
| Mean | 0.247 | 0.257 | 0.230 | 0.247 | 0.240 | 0.244 |

[a] Microsites are shown in Fig. 2.

## IMPLICATIONS

This study is based on the 5-year performance of 11 plantings, during a 3-year period, well distributed throughout the boreal forest region of Ontario and replicated in three successive years.

The results do not appear to justify mounding as a method of site preparation for the planting of jack pine and black spruce bareroot stock in boreal Ontario. Mounding did not enhance survival or RGR (height) in comparison with planting on the shoulder of unmodified Bräcke patches. Both species performed well after planting on the shoulder of unmodified Bräcke patches.

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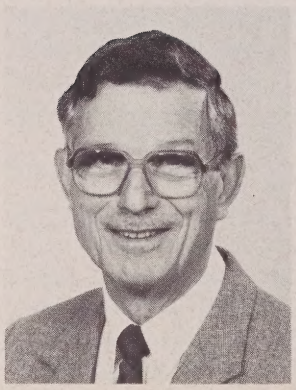

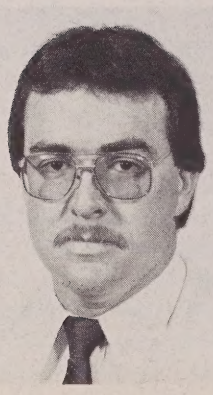

Dr. Roy Sutton (left) studies the growth and nutrition of boreal conifers and the biology of stand establishment.

Tom Weldon (right) is a tree biology technician and research assistant to Dr. Sutton.

R.A. Haig was contracted by the Research Applications and Liaison Section, FCOR, to assist in the preparation of technical notes. Currently retired, he is a former Deputy Regional Director of FCOR.

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